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We take great pleasure in announcing the names of the following gentlemen as occasional contributors to this Journal. Several others whom we have addressed have not yet returned answers.—There are, also, many others who have continually lent us their aid, but who are at present absent from their usual places of residence, and whose names we shall be most happy to add at some future time. The following gentlemen may, therefore, be considered as contributors to the Journal, as their leisure may from time to time allow :—

Joseph E. Bloomfield, Esq.
Wm. R. Casey, C. E.
P. P. F. Degrand, Esq.
Chas. Ellet, C. E.
Chas. B. Fisk, C. E.
E. F. Johnson, C. E.
Benj. H. Latrobe, C. E.
Wm. C. Redfield, Nav. Eng.
and agent Steam Nav. Co.
Jas. Renwick, L. L. D.
Prof. Nat. and Exp. Phil. and Chemistry.
J. E. Shipman, C. E.
Edw. Shotwell, C. E.
Chas. B. Stewart, C. E.
L. A. Sykes, C. E.
Jas. Ed. Thompson, C. E.
John C. Trautwine, C. E.

To all these gentlemen we beg leave to offer our thanks for their prompt reply to our communications, and for the kind interest they have showed in behalf of our undertaking.

NEW EXPERIMENTS ON FRICTION, MADE AT METZ, IN 1831, 1832, AND 1833, BY ARTHUR MORIN, CAPT. OF ARTILLERY.

[Continued from page 8.]

The mode of conducting the experiments having been described in the last number, the results will now be given in a tabular form. It may, however, be remarked, that in the original memoirs each experiment is given in detail with the calculated results, and in most instances with full remarks upon the attendant circumstances. The large number of the curves, traced during these experiments, are shown; but as the object of these, as well as of much of the substance of the memoirs, is to demonstrate the general laws of friction, they need not be repeated. Enough has already been said to convince our readers of the accuracy of the results; and, when we add that each numerical value, contained in the tables, is the mean of a number of experiments, made at different velocities and pressures, and with surfaces of various extent, it will be seen that these values can be employed with the most entire confidence.

The general laws are announced as follows:

I. The friction is proportioned to the pressure.

II. Independent of the velocity.

III. Independent of the extent of surface in contact.

These laws, formerly considered as approximations, are now demonstrated to be strictly and exactly true.

The inspection of the tables will at once give rise to many reflections, which each one may apply for himself, we omit, therefore, all this portion of the work, which being appropriate during the detail of individual cases, is no longer needed when the whole is brought under the eye at once.

The first table contains all the values of frictions ascertained for bodies in motion. The second, (to follow in another number) the frictions caused by substances having remained some time in contact, or what might be called the friction of separation. The third, taken exclusively from the third memoir, refers entirely to the friction of building materials.

Explanation of the Tables.

The first table contains the number of the results, and has been added for convenience in referring to the table.

The second column contains the names of the substances employed, and the order of position: thus, oak upon iron will be found in one place, and iron upon oak in another. The difference caused by the change in position will be found highly interesting, particularly in the case of the metals.

The third column indicates the nature of the substance applied to the surfaces. For the sake of convenience in reference, we have abridged the prolixity of the original tables without leaving any thing unexpressed. The values standing at the head of the table are from the first memoir, and were made without any unguent, properly so called. The condition of the surface is denoted by the terms *wet* and *dry*. When the surfaces are said to be *wet*, it is to be understood, that if capable of being thoroughly soaked in water, they are in that condition. In the remaining portion of the table, (taken from the second memoir) the sign 0 denotes a naked or unprepared surface; *water* is to be understood with the same qualification as above; *olive oil, tallow* and *lard*, denote these substances in their ordinary conditions. The *dry soap* used, was the best quality of blue Marseilles soap, very hard and dry, and pieces of oak well rubbed with it, and then wiped, showed to a casual observer nothing upon their surface, yet the friction was reduced from ·478 to ·164. The substance called *mineral tar*, or asphaltum oil, is said to be viscous, of a reddish brown color, and very much resembling thick molasses. It is found at Bechelbronn, Lower Rhine, and has long been used for the axles of wagons, &c. The author remarks that this substance, unless abundantly used, allows the resistance to increase rapidly until it attain a value nearly as great as if no unguent had been used. This is not the case with paper fats or oils, and is evidently owing to the volatility of the naptha which constitutes a large portion of it. The anti-attrition compound, denoted as *lard* and *plumbago*, consists of *four* parts of the former and *one* of the latter. The term *wheel grease* (*cambouis*) is applied to the substance taken from the axles of vehicles long in use, and, of course, of a very tenacious consistency. Before the experiment it was freed from foreign substances and remelted. No mention is made by the author of the original materials of this composition; we presume that it is nearly or quite the same that is used generally for this purpose.

The word *greasy* denotes that state in which surfaces are left after grease has been employed and then wiped off as much as possible. It is evident, as the author observes, that it is not always possible to produce the same amount of unctionity, the results are

therefore not entirely comparable, still they are useful as representing the state in which surfaces may be found after having discontinued the use of an unguent for some time.

The fourth column describes the direction of the fibres both mutually and in reference to the direction of motion. It appears that in all cases the fibres of the lower piece were parallel to the direction of motion, so that the terms in this column may be understood as referring to both. Thus *parallel* denotes that the fibres of the sliding body were parallel to those of the one beneath and to the motion; *perpendicular*, that they were at right angles with the fibres beneath and the direction of motion; *vertical*, that the sliding piece of work is placed on end, the rest remaining as before. In the case of a fibrous substance sliding over bronze or cast iron, the reference is of course only to the direction of motion.

The fifth column contains the numerical values expressed decimally; we have retained this form as being the best suited for comparison and calculation. A few of tne results, from the first memoir, from 1 to 18, will be found repeated in the remainder of the table with slightly different values. In this case the latter are always to be preferred as the most correct.

TABLE I.

FRICTION OF PLANE SURFACES IN MOTION.

No.	Nature of Surfaces.	Condition of Surfaces as to unguent.	Arrangement of fibres.	Proportion of friction to pressure.
1	Oak on oak,	Dry,	Parallel,	·48
2	" "	"	perpendicular,	·32
3	" "	wet,	"	·25
4	elm on oak,	dry,	parallel,	·43
5	" "	"	perpendicular,	·45
6	ash on oak,	"	parallel,	·40
7	fir on oak,	"	"	·36
8	beech on oak,	"	"	·36
9	wild pear on oak,	"	"	·40
10	wrought iron on oak,	"	"	·62
11	brass on oak,	"	"	·62
12	dressed leather on oak,	"	"	·27
13	rough sole leather on oak,	"	leather laid flat,	·52
14	" "	"	leather laid edgewise,	·34
15	" "	wet,	"	·29

No.	Nature of Surfaces.	Condition of Surfaces as to unguent.	Arrangement of fibres.	Proportion of friction to pressure.
16	Thong of hemp on oak,	Dry,	Parallel,	·52
17	plait of small cords of hemp on oak,	"	"	·32
18	hempen rope ½ in. in diameter, on oak,	"	"	·52
19	oak on oak,	dry soap,	parallel,	·164
20	" "	tallow,	"	·075
21	" "	lard,	"	·067
22	" "	greasy,	"	·108
23	" "	0	perpendicular,	·336
24	" "	tallow,	"	·083
25	" "	lard,	"	·072
26	" "	greasy,	"	·143
27	" "	0	vertical,	·192
28	beach on oak,	tallow,	parallel,	·055
29	" "	greasy,	"	·153
30	elm on oak,	dry soap,	"	·137
31	" "	tallow,	"	·070
32	" "	lard,	"	·060
33	" "	greasy,	"	·119
34	hide leather on oak,	0	"	·296
35	wrought iron on oak,	water,	"	·256
36	" "	dry soap,	"	·214
97	" "	tallow,	"	·085
98	cast iron on oak,	0	"	·490
99	" "	dry soap.	"	·189
100	" "	water,	"	.218
101	" "	tallow,	"	·078
102	" "	lard,	"	·075
103	" "	olive oil,	"	·075
104	" "	greasy,	"	·107
105	copper on oak,	tallow,	"	·069
106	" "	greasy,	"	·100
107	hemp on oak,	water,	perpendicular,	·332
108	elm on oak,	dry soap,	parallel,	·139
109	" "	greasy,	"	·140

No.	Nature of Surfaces.	Condition of Surfaces. as to unguent.	Arangement of fibres.	Proportion of friction to pressure.
110	oak on elm,	0	"	·246
111	" "	dry soap,	"	·136
112	" "	tallow,	"	·073
113	" "	lard,	"	·066
114	" "	greasy,	"	·136
115	cast iron on elm,	0		·195
116	" "	tallow,		·077
117	" "	olive oil,		·061
118	" "	lard 4 parts and plumbago 1 part,		·091
119	" "	greasy after tallow,		·125
120	" "	greasy after lard and plumbago,		·137
121	wrought iron on elm,	0	parallel,	·252
122	" "	tallow,	"	·078
123	" "	lard,	"	·076
124	" "	olive oil,	"	·055
125	" "	greasy,	"	·138
126	oak on cast iron,	0	perpendicular,	·372
127	" "	tallow,	parallel,	·080
128	" "	greasy,	"	·168
129	elm on cast iron,	tallow,	"	·066
130	" "	greasy,	"	·135
131	hornbeam on cast iron,	0	"	·394
132	" "	tallow,	"	·070
133	" "	lard,	"	·071
134	" "	lard and plumbago,	"	·055
135	" "	olive oil,	"	·068
136	" "	mineral tar,	"	·060
137	" "	wheel grease,	"	.095
136	" "	greasy,	"	·136
137	lignum vitæ on cast iron,	tallow,	"	·074
138	" "	olive oil,	"	·076
139	" "	greasy,	"	·121
140	wild pear on cast iron,	0	"	·436
141	" "	tallow,	"	·067
142	" "	lard,	"	·068
143	" "	greasy,	"	·173
144	hide leather on cast iron,	0	leather flat,	.559
145	" "	water,	"	·365

No.	Nature of Surfaces.	Condition of Surfaces as to unguent.	Arrangement of fibres.	Proportion of friction to pressure.
146	hide leather on cast iron,	tallow,	leather flat,	·159
147	" "	olive oil,	"	·133
148	" "	leather greasy, iron wet,	"	·229
149	" "	water,	leather edgewise,	·238
150	" "	olive oil,		·135
151	cast iron on cast iron,	0		·152
152	" "	water,		·314
153	" "	soap,		·197
154	" "	tallow,		·100
155	" "	lard,		·070
156	" "	olive oil,		·064
157	" "	lard and plumbago,		·055
158	" "	greasy,		·144
159	wrought iron on cast iron,	0	parallel,	·194
160	" "	tallow,	"	·103
161	" "	lard,	"	·076
162	" "	olive oil,	"	·066
163	" "	wheel grease,	"	·124
164	steel on cast iron,	0	parallel,	·202
165	" "	tallow,	"	·105
166	" "	lard,	"	·081
167	" "	olive oil,	"	·079
168	" "	greasy,	"	·109
169	brass on cast iron,	0		·189
170	" "	tallow,		·072
171	" "	lard,		·068
172	" "	olive oil,		·066
173	" "	wheel grease,		·134
174	" "	greasy,		·115
175	bronze on cast iron,	0		·217
176	" "	tallow,		·086
177	" "	olive oil,		·077
178	" "	greasy,		·107
179	hemp on cast iron,	tallow,	perpendicular,	·194
180	" "	olive oil,	"	·153
181	oak on wrought iron,	tallow,	parallel,	·098
182	" "	greasy,	"	·149
183	cast iron on wrought iron,	tallow,		·098

No.:	Nature of Surfaces.	Condition of Surfaces as to unguent.	Arrangement of fibres.	Proportion of friction to pressure.
184	" "	lard,		·058
185	" "	olive oil,		·063
186	" "	wheel grease,		·155
187	" "	greasy,		·143
188	wrought iron on wrought iron,	0	parallel,	·138
189	" "	tallow,	"	·082
190	" "	lard,	"	·081
191	" "	olive oil,	"	·070
192	" "	greasy,	"	·177
193	steel on wr. iron,	tallow,	"	·093
194	" "	lard,	"	·076
195	bronze on wr. iron,	0	"	·161
196	" "	tallow,	"	·081
197	" "	lard and plumbago,	"	·089
198	" "	olive oil,	"	·072
199	" "	greasy,	"	·166
200	lignum vitæ on bronze,	tallow,	"	·082
201	" "	olive oil,	"	·053
202	" "	greasy,	"	·146
203	hide leather on bronze,	tallow,	leather flat,	·241
204	" "	olive oil,	"	·191
205	" "	leather greasy bronze wet,	"	·287
206	" "	tallow,	leather edgewise,	·138
207	" "	olive oil,	"	·135
208	" "	leather greasy bronze wet,	"	·244
209	cast iron on bronze,	0		·147
210	" "	tallow,		·085
211	" "	lard,		·070
212	" "	olive oil,		.067
213	" "	greasy,		·132
214	wr. iron on bronze,	0	parallel,	·172
215	" "	tallow,	"	.103
216	" "	lard,	"	·075
217	" "	olive oil,	"	·078
218	" "	wheel grease,	"	·168
219	" "	greasy,	"	·160
220	steel on bronze,	0	"	·152

No.	Nature of Surface.	Condition of Surfaces as to unguent.	Arrangement of fibres.	Proportion of friction to pressure.
221	" "	tallow,	"	·056
222	" "	olive oil,	"	·053
223	" "	lard and plumbago,	"	·067
224	" "	wheel grease,	"	·170
225	bronze on bronze,	0		·201
226	" "	olive oil,		·058
227	" "	greasy,		·134

CAUSES OF FAILURE OF CERTAIN RAIL-ROADS IN THE UNITED STATES.

The pamphlet recently put forth by Mr. Ellet, on this subject, has very properly excited a great deal of attention, on account both of the important nature of the subject, and the remarkable views of the author. The pamphlet having been republished in this Journal, together with certain articles in its favor, and at the same time the opposite side of the question having been argued very fully in certain other articles, our readers are doubtless by this time fully acquainted with the merits of the question. We have expressed our individual opinion as adverse to the views of Mr. Ellet, nor have the arguments more recently brought forward in favor of his position tended to change our previously expressed opinion that these views, however correct in a few instances, are by no means as generally applicable as seems intended.

It is, however, far from our intention to prevent a free and fair discussion of the subject, which is demanded, both by the standing of the parties and the useful results which may grow out of it.

Discussions of this kind are very apt to deal in generalities, and gradually lose sight of the actual points at issue. Desirous of avoiding this, it is proposed to give a few hints of the leading heads under which the legitimate discussion of the question must ultimately fall. It has occurred to us that the observation of those gentlemen who seem disposed to advocate Mr. Ellet's side of the question has generally been directed to a different section of the country from that of those who entertain different views, hence we may be allowed to suppose that the defects complained of by Mr. Ellet prevail more generally in some sections of the country than in others. In short, that while extravagance in the construction of roads and a blind imitation of the English system *may* be noticed in individual instances, the same faults may not be observed, even in unsuccess-

ful Rail-roads, in other parts of the country. In order to satisfy all parties upon this point, and in fact to lay the very foundation of all argument upon the question it will be necessary to obtain a list of all the Rail-roads commenced or completed in the United States; their lengths, cost and annual receipts and expenditures, together with such other statistical details as may be required to form a correct judgment of their actual condition.

Another very important circumstance to be considered, is the difference between the actual condition and value of a stock and its price in the market. To persons at a distance and unacquainted with the mysteries of stockjobbing, the price of stocks is considered a fair criterion of the value of the undertaking. Nothing can be more delusive than such an opinion. In the commencement of the construction of a Rail-road, one or more instalments must be called in, and the immediate effect will be a decline of 5 per cent. or more, according to the amount called in and the scarcity of money at the time.

Again, the operation, technically known as cornering, may raise the price to an unprecedented height without any change in the circumstances of the company. The facility with which the stocks of uncompleted works may be obtained has been the means of greatly swelling the list of what are called "fancy stocks," which are ever after the mere foot-ball of speculators who have not the slightest desire of forwarding the true interests of the undertaking.

The discredit attached to this kind of speculation has indirectly produced unfavorable effects upon the character of Rail-roads as an ve stment, from which, however, they are now recovering. It must also be remembered that many of the best Rail-roads never appear in the lists of stock quotations to counterbalance the low character of the "fancy stocks."

Many Rail-roads, properly constructed and adapted to an extensive traffic, have been ruined by subsequent mismanagement, either from the ignorance or fraud of directors. Improper interference, from the same quarter, with the location of the work has produced the same results.

Finally, it would be difficult to assign any cause or causes for the failure of Rail-roads that would not apply to all other unsuccessful operations in these times of distress and depression, and the reasons assigned for these last are as many as the miles of Rail-road in the United States. May we not, therefore, justly conclude that no one two or three causes can be found for the want of success of *all* of the unsuccessful Rail-roads in the United States.

Enough has been said to show the amount of research necessary for the accurate investigation of this question, and we need say no more to convince our readers of the injury that may be caused by the improper management of the discussion.

[For the American Railroad Journal, and Mechanics' Magazine.]

"A PRACTICAL DESCRIPTION OF HERRON'S PATENT TRELLIS RAILWAY STRUCTURE."—*Carey & Hart, Philadelphia.*

There is no country in the world—not even England herself—so much interested in the subject of railroads as the United States. And this is the case, not alone, because we have more capital invested in them, and a much greater extent of them in actual operation, than any European country, but because they are more necessary to us—to the developement of vast resources and the progressive improvement of our boundless territory—than they can possibly to any other people. It is natural, therefore, that we should look with a deep interest to any improvement which may tend to remove the serious defects, acknowledged on all hands to exist in the present methods of railway superstructure. The high hopes that were entertained a few years ago, as to the results of the system, have certainly not been realized. As a profitable investment of capital it may be considered a complete failure, and this is sufficient to put a check to its further progress, unless some effectual remedy be devised for the evil which lies at the bottom of the system.

* The failure of our railroad system is not attributable to the want of patronage; for the receipts on most of our principal lines for the transportation of freight and passengers, are immense; but they are nearly all swallowed up in the constant repairs of *road and machinery;* and it is well known to all practical engineers that the whole mischief grows out of the *defects of the present modes of superstructure.* The great end of railway structures being the attainment of a permanently *hard even elastic surface, which will offer the least possible resistance to the bodies that have to pass over them,* the slightest deviation from this standard constitutes an imperfection in the structure, which goes to defeat its object and lessen its value. No one who will travel over even the best of our railroads, or cast his eye along their undulating surfaces, will require any other argument to convince him that the great end of Railway structures *is not attained.* "The whole line is a series of short elastic planes, divided only by the regid points of support. This gives to the en-

* We need hardly say that we conceive these assertions to be erroneous.—Ed.

gines and carriages the ruinous undugatory or bounding motions, and as the deflexure of the rails is more considerable next the joints a lurch is added to the bound, which thus results in an awkward wabbling quit, that very soon destroys the engines, carriages, and railway, causing the enormous amount of annual repairs, that absorbs in so many cases the whole income of the railway." We venture to assert, without fear of contradiction, that *no railway has ever yet been constructed in England, or in this country, that has preserved the characteristics of a perfect railway for one moment after the first locomotive and train have passed over it!* From that moment it is *more or less* deranged. The cause is obvious. The superstructure is dependent on, and identified with, the road-bed; and as it will always be found impossible to make all descriptions of soil to "settle" equally, and be equally effected by frost and moisture, so will it be found that the railroad structures *which are dependent upon them,* must yield to their inequalities, and present, instead of a perfectly even surface, a long succession of small hills and valleys; the effects of which are found in the rapid wear and tear of the machinery, as well as of the road itself; the constant necessity for watching and propping the ricketty superstructure, the increased friction, the decreased speed, the frequent accidents, the breaking of axles, the jumping off the tracks, &c. It results then: *First,* that all the evils of the system are in proportion to the extent of the imperfection of the track; or its deviation from the standard of a perfect railway. *Secondly,* That this imperfection, and all its train of evil consequences, must continue as long as the present erroneous principle of construction shall continue; which makes the superstructure dependent for its evenness of surface on the road-bed; which, in the nature of things, never can be relied on for that purpose.

Enough has been said, if indeed it was necessary to say any thing, to show that our whole system of railway superstructure is extremely defective, and based on wrong principles. This has long been acknowledged, but it was more easy to see and deplore the evil than to devise a remedy for it. This remedy however we sincerely believe has at last been found, and we acknowledge an honest pride in knowing that it is to the genius of one of our own countrymen we are indebted for an improvement, which, in its practical results, will be of great importance to our country; and will, at the same time, aid us in carrying on with foreign nations, that noble commerce in the products of science and genius by which we acknowl-

edge ourselves to have been so often benefited, and what we are always happy to reciprocate.

The "practical description of the Trellis Railway Structure," published by Mr. Herron, renders it unnecessary, in a notice of this kind, to enter into the details of his improvements; for those who take an interest in such subjects will refer to the work itself, which ought to occupy a place in the library of every engineer. We will proceed, however, to point out the distinguishing characteristics of the new system. As all the evils of the old system grow out of the dependence of the superstructure on the road-bed, and from its too limited surface bearing on the soil; the grand desideratum attained by the new system, is the almost entire independence of the superstructure of the road-bed. Instead of cross ties and string pieces loosly connected and having little bearing on the surface, the improved tract is a trellis frame work, deriving immense strength from the mechanical principle applied in its construction, and having a very extensive bearing surface on the soil. It is in fact a *strong continuous bridge* which cannot be affected by ordinary inequalities in the road-bed; *nor admit of the slightest vertical or lateral derangments as long as the materials last of which it is constructed.* There are many other improvements, such as a *new* scarph for joining the ends of the string pieces, a new wrought iron chain for securing the ends of the iron rails, and some of minor importance, constituting the whole a beautiful system, and showing in the inventor a thorough and practical knowledge of all the difficulties to be encountered, and an ingenuity and talent fully equal to the task of surmounting them. His estimates prove that the improved structure will cost *less* than the present ones, and this is corroberated by the experiment made on the Baltimore and Susquehanna Railroad. This experiment made on the Baltimore and Susquehanna Railroad two years ago, it appears, from the Baltimore papers, has realized all that was expected from the new system. "*It is in as perfect order, after having stood the breaking up of two winter's frost, as it was the day it was laid down, although it has not received the slightest repair. It has not been touched!*" On a recent visit to Baltimore, we visited and examined the new tract laid down on the Baltimore and Susquehanna Railway near the city, and were struck with the contrast between it and the adjoining track laid down on the old plan. Although it had been in operation two years it was still a *perfect railway*, not having suffered the slightest displacement, vertical or lateral while constant ramming and propping could not keep the adjoining road, constructed on the old plan, in as good condition!

No scientific engineer could read Mr. Herron's work and study his plates and models without being convinced of the soundness of his principles, and yielding to the cogency of his reasoning; but for the world at large something more was necessaryly the actual test of experiment was required. This is now triumphantly appealed to, and all interested in the subject may satisfy their minds by referring to Charles Howard, Esq. President of the Baltimore and Susquehanna Railroad Company for a confirmation of the facts herein stated.

[From the Civil Engineer and Architect's Journal.]

INSTITUTION OF CIVIL ENGINEERS.

"*Description of the Tanks for Kyanizing the Timber for the permanent way of the Hull and Selby Railway*" By John Timperley.

Upon the recommendation of Messrs. Walker and Burges, the Engineers, it was determined that the sleepers of this railway should be kyanized in close vessels, using exhaustion and pressure, instead of in the open tanks usually employed. The present communication, which includes a description of the kyanizing vessels, and an account of the various circumstances connected with the operation, commences by describing the apparatus, to consist of two tanks, a reservoir, two force pumps, and a double air pump. The tanks are cylindrical, with flat ends, and are made of wrought iron plates, nearly half an inch in thickness; they are 70 feet in length, and 6 ft. in diameter; at each extremity is a cast iron door, flat on the outside, and concave on the inner side, provided with balance weights for raising and lowering it. Each end is strengthened by five parallel cast iron girders, whose extremities are held by wrought iron straps rivetted on to the circumference of the tanks. Notwithstanding the great strength of these girders, several were broken by the pressure applied during the process. The vessels are lined with felt, upon which is laid a covering of close jointed fir battens, fastened with copper rivets; this precaution is necessary to prevent the mutual deterioration which would arise from the contact of the iron and corrosive sublimate. There was originally only one brass force pump, 2 in. diameter, and 6 in. stroke; this being found insufficient, another was added of 4 in. diameter, and henceforward a pressure of 100 lb. per square inch was easily obtained. The air pump is 10 in. diameter and 15 in. stroke. Its construction is of the ordinary kind. The author gives in an appendix to the paper a minute description of the various parts of the apparatus, with the details of their dimensions and weight. The process is simple and rapid; the corrosive sublimate is first mixed with warm water in a trough, in the proportion of 1 lb. of the former to 2 gallons of the latter; the clear solution is then poured off into the reservoir, where water is added till it is diluted to the proper point, which may be ascertained by an hydro-

meter; a more perfect test is the action of the solution upon silver, which it turns brown at the requisite degree of saturation. The operations of exhaustion and pressure employ eight men for five hours, the whole process occupying about seven hours, during which time from 17 to 20 loads are kyanized in each tank. It is desirable that the timber should remain stacked for two or three weeks after kyanizing before it is used. It was found that about ¾ lb. of corrosive sublimate sufficed to prepare one load (50 cubic feet) of timber. About 337,000 cubic feet of timber were kyanized, the average expense of which, including part of the first cost of the tanks, was about 5*d.* per cubic foot. The timber was tested after the process, and it was found that the solution had penetrated to the heart of the logs.

The paper contains some interesting tables exhibiting the quantity of the solution taken up by different kinds of wood with-without exhaustion; from these it appears that the saturation per cubic foot, in the latter case did not exceed 2·25 lb. with specimens of Dantzic timber, whereas it ranged between 12·24 lb. and 15·25 lb. with pieces of home-grown wood. The author observes that this striking difference may be partly due to the greater compactness of the foreign timber. Appended to this communication is a correspondence between Mr. J. G. Lynde and Mr. James Sampson relative to the best tests of the presence of corrosive sublimate, accompanied by letters from Mr. Colthurst and Dr. Reid; the former of these describes the process of kyanizing adopted on the Great Western Railway, and the latter suggests the three following tests:—1st, dilute hydro-sulphuret of ammonia; 2nd, a strong solution of potassa; dilute nitric acid and proto-muriate of tin, also gold-leaf with this solution; and 3rd, iodide of potassum. Directions are given for the application of these tests.

Mr. Lynde also mentions the use of a solution of nitric acid. and by the application of hydriodate of potash detecting the presence of mercury in a specimen taken from the heart of a log of timber 10 in. by 5 in., and 9 ft. long. He also details appearances of the destructive action of the corrosive sublimate upon the iron-work with which it came into contact, which would be prejudicial to the use of iron bolts in kyanized sleepers.

A drawing explanatory of the whole apparatus accompanied the communication.

Remarks.—In answer to questions relative to the process of exhausting the air from the receiver in which the bank-note paper was wetted at the Banks of England and Ireland previously to being printed, Mr. Oldham stated that as an experiment a packet of 1000 sheets of paper had remained a whole day in water without being wetted through; whereas by exhausting the air from the vessel containing them to a partial vacuum of 22 inches of the barometer, and admitting water, they had been perfectly saturated in five minutes; the edges of the paper in simple immersion would rot away before the mass was saturated; by the exhausting process 5,000 sheets of bank-note paper would absorb 16 lb. of water.

Mr. Simpson conceived that exhaustion would facilitate the process of kyanizing; but he believed that if time was allowed, pressure would accomplish the same end as perfectly, for he had observed that pieces of wood which had remained four or five days in a water-main under pressure had become perfectly saturated. Captain Scoresby, in his account of the whale-fishery, remarks that when a whale carries a boat down it rarely rises again, most prabably because the fish plunges to such a depth that the extreme pressure water-logs the boat; instances had been known of the specific gravity of the planking being doubled by being carried down.

Mr. Newton remarked that immersion of timber in close tanks had been practised by Mr. Langton many years since for bending timber; a boiling fluid was used in the tanks, and the wood was subjected to heat for a considerable period. He had understood that Mr. Newmarch of Cheltenham was the first person who used corrosive sublimate for preserving timber, and that he had prepared and employed considerable quantities of wood. Mr. Kyan subsequently revived the system.

In Mr. Oldham's process of wetting paper, pressure was not requisite, on account of its open texture. About the year 1819, Mr. Oldham had tried the same process with perfect success for preserving meat.

Exhaustion had been tried by Mr. Harris for cleansing wool. The cops of wool were put into an exhausted receiver, a solution of an alkali was then admitted; after remaining a short time in the liquid, a sufficient quantity of diluted acid was added to neutralize the alkali, and the wool was washed out in clean water. The process succeeded perfectly, but was too expensive.

Mr. Palmer had employed the kyanizing process for large pieces of timber, for the ribs of lock gates, but had no means of ascertaining the depth to which the mercury had penetrated. The use of corrosive sublimate was first suggested by Sir H. Davy in his lectures at the Royal Institution, as a means of destroying the vegetating process in timber by the combination of the chlorine in the former with the albumen of the latter. Mr. Palmer much doubted whether the means used for exhausting the capillary tubes effected the object, unless the timber was in a dry state, and he considered it equally doubtful whether the solution could be forced to any considerable depth by compression, especially if any moisture actually filled the capillary tubes. The application of pressure in the process of salting meat suggested by Mr. Perkins many years ago, was a complete failure.

Mr. Simpson observed that in the experiments of Messrs. Donkin and Bramah, pressure alone had been used, and it could easily be understood that owing to the cellular formation of meat, the pressure, instead of forcing the salt through it, caused the substance to collapse and the brine was prevented from penetrating.

Mr. Braithwaite explained that in Payne and Elmore's process, although pressure had been found indispensable, the meat was more

perfectly prepared when exhaustion was also employed, therefore both were now combined.

Mr. May reverted to the subject of kyanizing timber; he believed that exhausting the air from the tanks previously to the admission of the solution was a loss of time—the fluid should be admitted first, or at least while the exhaustion was proceeding; labor and time would thus be saved, and the air would be more completely expelled from the capillary tubes before pressure was applied. It was essential that the timber should be as far as possible deprived of its sap as well as dried; as either sap or moisture appeared to prevent the proper action of the corrosive sublimate.

Mr. Cubitt regretted that experiments had not been made on the same kinds of wood both with and without exhaustion. The experiments on small pieces of foreign (Memel and Dantzic) timber with 80 lb. to 100 lb. pressure without exhaustion, showed an increase of weight of from $1\frac{1}{2}$ to 2 oz. in pieces of about $\frac{1}{70}$ part the size of a sleeper, and that result agreed very nearly with his practice with sleepers of Memel and Dantzic timber, when kyanized without exhaustion under a pressure of 80 lb. to the inch; sleepers of $2\frac{1}{2}$ to $2\frac{3}{4}$ cubic feet, gaining from 3 lb. to 5 lb. in weight by the process. No result had been given of experiments with the sleepers of foreign fir timber, in which both exhaustion and pressure had been applied, but it appeared that the Scotch fir sleepers weighing 100 lb. when kyanized under exhaustion and a pressure of 100 lb. to the inch, gained 33 per cent. in weight, which was equal to three gallons of water being forced into less than 3 cubic feet of timber; he thought that this difference could not be all due to exhaustion, but that it must depend greatly upon the quality of the wood, because under a pressure of 100 lb. to the inch, the air contained in a tubular substance (such as fir timber) would all be compressed about $\frac{1}{8}$ of its natural bulk without previous exhaustion, so that the differene between 5 lb. and 30 lb. forced into a sleeper, could not, he thought, be all due to exhaustion, but must depend upon other circumstances not explained in this paper.

The President thought that the greater degree of absorption by the Scotch fir might be accounted for by its open texture, whereas the foreign timber was more compact and also contained more turpentine. It might also have been wetter than the Scotch fir, which he believed had been the case.

Mr. Taylor observed that hitherto the attention of the meeting had been entirely directed to mechanical action, but that the chemical combination of the corrosive sublimate with the albumen of the wood, was the point most insisted upon by Kyan; it was supposed to be similar to the operation of tanning hides, in which the tanning of the bark combined with and saturated the animal gelatin, which would not otherwise be permeable by the fluid in which it was placed.

Lieut. Oldfield suggested that if the timber, when piled in the tank was subjected to the action of heat at 212°, the moisture contained in the capillary tubes would be expelled in the form of

steam, and that on the admission of the solution, the tubes would instantly be filled with it, because of the partial vacuum formed in them.

Mr. Colthurst observed with regard to the tests for ascertaining the amount of saturation of the timber, that he had tried all those described by Mr. Lynde, and had not been able to discover the presence of mercury in the heart of any of the timbers prepared for the Great Western Railway; their dimensions were 6 in. by 12 in. Dr. Faraday had, he believed, detected it by the aid of the galvanic battery in the heart of a piece of timber 2 ft. square, after simple immersion in the solution for fourteen days.

Mr. Moss had tried many experiments as to the most delicate tests for ascertaining the depth to which the mercury had penetrated; the most satisfactory test was gold-leaf, as from its strong affinity for mercury, the presence of the latter was immediately detected. The mode of proceeding was to put some fibres of the wood to be tested into a small test tube, mixed with a portion of dry carbonate of soda; then to place over, but not in contact with it, a small piece of gold-leaf, and apply heat to the bottom of the tube. If any mercury was present, in however small a quantity, the fumes would rise and discolor the gold-leaf.

Mr. W. Cubitt said that timber was at all times, more or less, charged with moisture; he had found deals, supposed to be dry, lose 10 per cent. of their weight from steam drying; it was evident that the presence of moisture in the pores of the wood must militate against the success of kyanizing by simple immersion, unless it was continued for a very long period. In close tanks, when exhaustion and pressure were resorted to, the moisture was perhaps of less importance; but still, if the sap was extracted, and the timber previously dried, the process of kyanizing would be more efficient.

Mr. S. Seward adopted Mr. Palmer's position, as to the almost impossibility of forcing the solution through the capillary tubes of a long piece of timber, the pressure being applied equally all over the surface: he believed the present method of kyanizing to be very imperfect, and alluded to a number of sleepers so prepared for the West India Dock warehouses having been recently discovered to be decayed.

Mr. Martin confirmed this account of the decay of the sleepers; fifty out of seventy were destroyed; they had been prepared by simple immersion, and had been down about five years. He had understood that some of the wooden tanks in which the solution was kept at the Anti-Dry Rot Company's yard were decayed.

Mr. C. May believed that the destruction of the tanks might have arisen from the constant corrosive action of the mercury, and not from decay. The capillary vessels of timber filled with air and sap, under exhaustion the air would expand and drive before it a considerable portion of the sap and moisture. In preparing the compressed treenails and wedges he used steam, and found that the pores were opened by it. He suggested that steam should be blown through the tanks until all the timber in them was raised to

a certain temperature, and then by opening the communication with the reservoir the solution would rush in and fill up the vacuum.'

Mr. Cowper believed that it was only necessary to bring the chlorine of the corrosive sublimate and the albumen of the timber into contact, when sufficiently dry, to insure the preservation of the wood. He had occasion to try experiments with paper pulp, and was constantly annoyed by its decaying—but the addition of a small quantity of chlorine had preserved it good for two years, and he believed that it would continue unchanged.

General Pasley confirmed the statement as to the increase of the specific gravity of timber from long immersion at considerable depths. He had found all the timber, except the mainmast, in the Royal George, at a depth of about 90 ft. water-logged. The oak timber had increased on an average more than 50 per cent. above its usual specific gravity.

Mr. F. Braithwaite remarked upon the doubt which appeared to exist among members as to the correctness of that part of Mr. Timperley's paper where a sleeper containing 3 cubic feet of timber was reported to have increased to 30 lb. in weight. Mr. Braithwaite had made some experiments, the results of which showed that a piece of Memel timber containing 533 cubic inches, and weighing when dry 9lb. became double its weight when subjected to a pressure of about 320 lb. per square inch without previous exhaustion; the machine which he used not being provided with an air pump. A smaller piece of American pine, containing 76 cubic inches, and weighing 1 lb. 7 oz. increased in weight to 3 lb. under a similar pressure. This, he contended, established the correctness of Mr. Timperley's Report. There appeared also to be a misconception as to the amount of corrosive sublimate employed; the paper states that ¾ lb. was the quantity used for each load of timber of 50 cubic feet. He promised to make some further experiments, and report them to a future meeting.

Mr. Bull had prepared considerable quantities of boards for the Calder and Hebble Navigation, by immersing them in the solution for two or three days, which was about double the period allowed by the patentees. He had some specimens of the boards, and in almost all of them there was an appearance of decay in various stages. An oak board, 1 in. thick, kyanized in 1839, had lain ever since upon the damp ground exposed to the air; the sap part was decayed, but the heart remained sound; fungus was, however, growing upon it. Poplar boards, kyanized in 1838, 39, and 40, were all partially decayed; those which were not prepared, and had been exposed in the same situation for the same period, showed, however, more symptoms of decay. In preparing the timber he had always followed the instructions of the patentees, and had tested the strength of the solution with the hydrometer, but had mixed up fresh solution even more frequently than was supposed to be required. On dismantling one of the tanks for holding the solution, he found the iron-work partially destroyed and entirely covered with globules of mercury.

Mr. Thompson explained that the hydrometer was not a correct testing instrument if any vegetable matter was present in the solution; that the tanks on the premises of the Anti-Dry Rot Company were necessarily made of unprepared timber; that the bichloride of mercury in solution would penetrate any length of timber, if the extremities of the sap vessels were exposed to its action, but that it would not penetrate laterally without pressure; it was not, therefore, surprising that a water-tight tank of unprepared wood should decay on the outside, even if filled with the solution. With regard to the strength of the solution, at first it was believed that 1 lb. of corrosive sublimate to 20 gallons of water was sufficiently strong, and much timber had been so prepared, but experience had since proved that the strength of the mixture should not be less than 1 lb. to 15 gallons, and he had never found any well-authenticated instance of timber decaying when it had been properly prepared at that strength: as much as 1 in 9 was not unfrequently used. In a cubic foot of wood prepared under a pressure of 70 lb. per square inch, mercury had been found by the galvanic battery to have penetrated to the heart.

Mr. Horne mentioned that a new process had been invented by Mr. Payne for rendering timber proof against dry or wet rot, and the ravages of insects; for increasing its durability and rendering it incapable of combustion. The mode of proceeding was to impregnate the wood with metallic oxides, alkalies or earths, as might be required, and to decompose them in the interior of the wood, forming new and insoluble compounds.

Mr. Taylor drew the attention of the meeting to a Memoir on the Preservation of Woods which had been read before the French Academy of Sciences by Dr. Boucherie. It was argued, that all the changes in wood were attributable to the soluble parts they contain, which cause fermentation and subsequent decay, or serve as food for the worms that so rapidly penetrate even the hardest woods. By analysis it was found that sound timbers contained from three to seven per cent. of soluble matter, and the decayed and worm-eaten, rarely more than one or two per cent.; since, therefore, the soluble matters of the wood were the causes of the changes it underwent, it became necessary for its preservation, either to abstract these soluble parts, or to render them insoluble, by introducing substances which should prevent their fermenting. This might be done by many of the metallic salts or earthy chlorides. Pyrolignite of iron was particularly recommended as being a very effective substance and cheaper than corrosive sublimate. The process was, to immerse the end of a tree, immediately after it was felled, in the solution of metallic salt, when, the vital energies not having ceased, the fluid was absorbed throughout all the pores of the tree, by a process which is termed "aspiration." The fluid had been applied in bags, to the base of the trees when in a horizontal position, or to one of the branches, or by boring holes to the heart, a few branches and a tuft of leaves being always left at the top of the principal stem. It was necessary to apply the

process speedily after felling the timber, as the vigor of the absorption was found to abate rapidly after the first day, and became scarcely perceptible about the tenth day, whilst in dead wood, or where there was any accidental interruption of the flow of the sap during growth, the "aspiration" entirely failed; resinous trees absorbed less of the fluid than any other. The ends proposed to be attained by this process were chiefly—preserving from dry-rot; increasing the hardness and the elasticity; preventing the usual changes of form or splitting; reducing the inflammability and giving various colors and odors, according to the nature of the fluid absorbed.

Mr. Bethell remarked that the process described in Dr. Boucherie's pamphlet, was identical with that patented by him July 11th, 1838, two years before Dr. Boucherie's was mentioned in Paris, which was in June, 1840. The specification filed by Mr. Bethell stated "that trees just cut down may be rapidly impregnated with the solution of the first class, hereafter mentioned (among which is included the pyrolignite of iron) by merely placing the butt ends in tanks containing the solution, which will circulate with the sap throughout the whole tree; or it may be done by means of bags made of waterproof cloth affixed to the butt ends of the trees and then filled with the liquid."—Mr. Bethell found that some solutions were taken up more rapidly by the sap and circulated with it more freely than others, and the pyrolignite of iron seemed to answer best; he had not hitherto introduced the process in England, because it was much more expensive than the oil of tar, the pyrolignite costing from 6*d.* to 9*d.* per gallon, and the oil being delivered at 3*d.* per gallon.—Mr. Bethell had used similar tanks to those described in Mr. Timperley's paper for preparing wood with the oil of tar, but as the oil is very penetrating, previous exhaustion of the air had been found unnecessary, the hydrostatic power being sufficient. The mode of working the tanks was to charge them with timber, close them and fill them with the oil; a hydrostatic pressure of from 100 lbs. to 150 lbs. to the inch was applied by means of the force-pumps, and kept up for about six hours; this was sufficient to cause the wood to absorb from 35 to 40 gallons per load. By this means a charge of timber was easily prepared daily, the cost being about 14*s.* per load. This was the plan pursued at Manchester for the Manchester and Birmingham Railway, by Mr. Buck (upon the recommendation of Mr. Robert Stephenson), and also at Bristol and Bridgewater by Mr. Brunell. Mr. Bethell preferred egg-shaped ends for the tanks as they resist the pressure better than flat ends. The solution of corrosive sublimate used at Hull appeared to Mr. Bethell to be very weak. The advice given by Sir Humphrey Davy to the Admiralty many years since was, to use 1 lb. of corrosive sublimate dissolved in 4 gallons of water, and Mr. Kyan in the specification of his patent states that strength, but according to the paper it appeared that 45 gallons of water were used to 1 lb. of the salt instead of 4 lbs.

In answer to a question from Mr. Pellatt, Mr. Bethell stated that

his experiments on the use of silicate of potash or soluble glass for rendering wood uninflammable, were not yet concluded; he had proved its efficacy in this point—that as soon as the prepared timber was heated, the glass melted and formed a filmy covering over the surface which protected it from the oxygen of the air and prevented its catching fire. The silicate also hardened the wood and rendered it more durable. This process was included in his patent of July 11, 1838.

Professor Brand could add but little to what had been said on the subject, but he mentioned a curious appearance in a beech tree in Sir John Sebright's park in Hertfordshire, which, on being cut down, was found perfectly black all up the heart. On examination, it was discovered that the tree had grown upon a mass of iron scoriæ from an ancient furnace, and the wood had absorbed the salt of iron exactly in the same manner as had been described in the new process. The degrees of absorption of various solutions by different woods demanded careful experiments, as some curious results would be obtained; it was a question whether a solution of corrosive sublimate in turpentine, or in oil of coal tar would not be advantageous, as both substances were so readily absorbed by timber.

REPORT OF THE ENGINEER IN CHIEF OF THE GEORGIA RAIL ROAD AND BANKING COMPANY.

ENGINEER DEPARTMENT, Geo. R. R. and B'kg. Co.
Greenesboro', April 15th, 1842.

To the Hon. JOHN P. KING, President Geo. R. R. and B'kg. Co:

SIR,—The enterprise as originally contemplated by the Georgia Rail Road and Banking Company, may now be considered as finished, and the expenditures constantly accruing during its construction, have been brought nearly to a close; upon which auspicious event, I offer the stockholders my sincere congratulations.

The cost of the entire Road—147½ miles in length—and outfit, consisting of Locomotives, Cars, Shops, Machinery, Depots, Water Stations and Dwellings, exclusive of Real Estate, Right of Way, &c., (not included in the original estimate) is $2,283,000; the estimated cost was $2,250,000. Including Real Estate, &c., &c., the cost is $2,363,000. A few expenditures yet remain to be made, but they are of little consequence and will not materially vary the result. Of the 147½ miles of road mentioned above, there are 104 miles from Augusta to Madison on the Great Southern Mail Route, called the main line; nearly 40 miles on a branch to Athens, and 3¾ miles to Warrenton. Of the main line 29 miles are constructed with a T rail of 46 lbs. per yard, and the remainder a flat bar of 29 tons per mile. The shortest radius of curvature, on any portion of the road, is 1,910 feet, and steepest gradient 7-10ths in 100 feet; (rather less than 37 feet per mile,) and this occurs west of Greenesboro' only. These maximum rates can be preserved with-

out difficulty, on the extension from Madison to the terminus of the Western and Atlantic Rail Road; upon which line the greatest inclination throughout its course to the Tennessee river is 33 feet per mile, and shortest curve 1,000 feet radius.

The surveys and construction of your road have occupied over seven years, during which time I have had the honor to conduct its operations, both in relation to the planning and execution of the work, and the organization and general management of the business of the road. As most of the members of the present Board were not among those with whom I first commenced my operations, I shall briefly refer to some past occurrences, for the purpose of explaining the origin of the present organization for conducting the transportation of the road, which it is important to the proper understanding of the subject, should be recollected. When but a small portion of the road was completed, the Board appointed a superintendant to whom I then, in consequence of the extent of my other engagements, hoped to have committed the entire charge of the work as it was placed in readiness for transportation. A very short trial of his qualifications, however, convinced them that these expectations could not be realised. A new organization then becoming necessary, a resolution was passed by the Directors, empowering me to organize the Departments requisite for conducting the business of the road in use, and to appoint all officers and fix their rate of compensation. In compliance with the duty thus imposed on me, I proceeded to effect the organization, which, with a few changes of Officers, has continued to the present time. By this arrangement, I continued in general control of the operations of the finished Road, and divided the several Departments, as follows:

1. For the Department of Transportation proper, a Superintendant was appointed, whose duty it is to see to the regular and safe transmission of all produce, merchandise, &c. sent by the Road. He also acts as assistant Gen. Agent of the Company, and in the latter capacity has, during the absence of the General Agent entire control of the other Departments. The purchase of supplies for the road, is likewise entrusted to him.

2. To the Superintendant of the Motive Power Department, the repairs and preservation of the Locomotives are entrusted, together with the general operations of the Machine Shops.

3. A Superintendant of the Car Factory, who is charged with the building and repairs of all the cars and other incidental carpenter work of the Company.

The two last officers also engage in the active manual labor of their shops.

4. The Maintenance of the Road, was confided to two Supervisors, now increased to three. To one is given the 49 miles of the Road, and the Branch to Warrenton; to another the remainder of the Main Line, 55 miles; and to the third, the Athens Branch, 40 miles. It is also the duty of the Supervisors to inspect all lumber for repairs and measure the wood obtained on their divisions for the Locomotives, &c.

The office of Superintendant of the first and most important department, was filled by the appointment of Richard Peters, Jr., (who had previously acted as my principal assistant engineer on construction,) the duties of which appointment he has continued to fulfil, with zeal and ability, up to the present time. The heads of the other departments, have since the first organization, been changed. The names of the present Superintendants will be found in Statement No. 8, together with a list of all the Officers of the Road and their rate of compensation.

This organization is thought to be as efficient as any that can be made; if however the Board should think a remodelling of it desirable, I beg that they will not consider me in the way of *any* change in the system that may seem to them best for the interest of the Stockholders.

The receipts of the Road for its ordinary business this year, exceeded those of last year, by $66,050 52. The number of passengers carried is 32,784, which is nearly the same as last year, but in consequence of the greater proportion of through travel, the amount received from them is increased $6,607 77. About 20 per cent of the whole travel, is brought to the head of the road in stages. the remainder of the increased receipts is on freight, except a small addition for mail service, and it is remarkable that the Up and Down freights only differ a few hundred dollars. The first, however, is derived chiefly from through transportation, while the latter is in a great measure picked up at the Way Stations. For instance, at Greenesboro', the receipts for Cotton are $6,450, and on Up Freight but $3,315; whilst at Madison, the receipts for Up Freight are $38,458 81 and for Down but $30,324; the disparity on the Athens Branch is still greater. The reasons for this are obvious.

Our whole receipt for Passengers, is $73,493 65, which, if we had had the privilege of charging at the low rate of 6 1-4 cents per mile, the amount would have been $91,867, an increase nearly sufficient to pay the whole expenses of "Conducting Transportation," and at this rate, I would venture to assert, that there would be no sensible decrease in the travel. I have before called the attention of the Company to this subject, and I again refer to it, from a conviction of its great and growing importance to their interest. I am aware that there is an opinion prevalent in the country, that low prices produce the largest net profits, and that this opinion, as erroneous as it is in its general application, is maintained by many of your own Stockholders. There is doubtless a medium rate, which will give to the Company the largest profits, and this rate, instead of being uniform and applicable to all roads, as generally supposed, is controlled by the amount and character of the travel on each work.

In Europe and the more densely peopled sections of our own country, where, in addition to an amount of travel proportioned to the greater population, there is a class of mechanics and laborers who would not use railroads at high rates—low fares are no doubt

both politic and profitable. But with us, this class is almost unknown, and our whole travel only averaged us 40 in 1839, and this year, 31 per day each way. When it is remembered that it costs nearly as much to convey these 31, as a train containing two or three hundred, it will at once be admitted that the rates adopted for that Road where this number can be obtained, are not applicable to our circumstances; yet such appears to have been the views of those who applied for our act of incorporation.

I have also objections to the limitations on our rates of freight, though in the aggregate they are sufficiently high. The true policy, it appears to me, is to allow these matters to be governed by the natural laws of trade, untrammelled by legislative restrictions. If, however, such must be imposed on the company, it should be on the amount of their dividends, which might be limited to a reasonable per centage on the cost of the work. Then, the several sources of the revenue of the Company, will be left free to bear each its due proportion of the current expenses.

It is conceded that there may be circumstances, even on our own road, which would justify a resort to low fares on a portion of the travel, not however lower than our present rates, (5 cents per mile;) but it would only be admissible under an agreement for a general reduction throughout an extended line, thus embracing a large amount of population, and with a view to divert the travel from other channels.

Such a project, having for its object a competition for the travel that now flows up the Mississippi, has been entertained by the several Railroad and Stage Companies on the great mail route, from Baltimore to Mobile, and favorably received by all except the S. C. Canal and Railroad Company, and in consequence of their opposition, has been abandoned for the present.

A reduction was made in our rates of freight on Cotton, after the commencement of the season, in conformity with the general wish of the Board of Directors, which has decreased our net receipts some $6,000. That we may be ultimately benefitted by this reduction is probable. After this season it is proposed to take Cotton by weight, instead of by the bale, in consequence of the advantage which many of the planters have taken of the company by enlarging the size of their bags; the price to vary according to circumstances, from 45 to 50 cents per 100 lbs. per 100 miles for Round Bales, and a reduction of 10 per cent. for Square Bales.

To encourage trade on the Athens Branch, the freight on Grain, the only article of export from that region which will bear transportation, has been greatly reduced. In consequence, some 2000 bushels of Corn, have been sent down since December last, which will no doubt steadily increase with the increased production of the country, stimulated by the demand created by the opening of a new market.

With a view of increasing our trade with East Tennessee and North Alabama, I sent an Agent into that region during the past summer, for the purpose of satisfying the merchants as to the ad-

vantages of shipping their goods by our route, His visit has been the cause of a considerable addition to our transportation, but was more especially beneficial in awakening the citizens of North Alabama to the policy of forming a direct mail communication with the head of your road. Representations were made from that region to the P. O. Department, simultaneously with those sent from this section, exhibiting the great importance of the connexion to the commercial and planting interests of the countries proposed to be connected, which have resulted in the invitation by the Post Master General, for proposals to transport the mail from Rome to Gunter's Landing, on the Tennessee river, and thence in steamboats to Ditto's Landing, (11 miles from Huntsville,) and to Decatur.—From Decatur the mail passes over the railroad to Tuscumbia, whence it is to be continued in coaches to LaGrange, and to Memphis, on the Mississippi river. The route is to be let this month, and will go into operation on the 1st of July next. From the head of your road to Rome, there is already a tri-weekly line of coaches. When the whole route is established, we may expect a large increase of travel, and also transportion, as the facilities offered by our improvement shall become better known. The country penetrated by this new line, is populous and wealthy, and in seeking this avenue to market, must add greatly to the prosperity of the southern Atlantic cities.

The following statement exhibits a condensed view of the business of the road and expenses, (omitting transportation for the company,) during the year ending on the 31st of March last. Detailed statements will be found accompanying this report, giving every information that can be desired on the subject.

CR.		
By Amount for Passengers Up,	$35,565 11	
" " " " Down,	35,895 72	
" " " Way Pass. on Branches and Tickets,	2,032 82	
" " " Freight Up,	59,610 10	
" " " " Down,	59,358 56	
" " " " Between Stations,	3,737 81	
" " " Premium, Interest, etc.	902 39	
" " " Transportation of Mails,	27,153 12	
		224,255 63
DR.		
For expenses of conducting Transportation,	22,699 97	
" " " Motive Power,	30,011 05	
" " " Maintenance of Way,	38,692 51	
" " " " Cars,	6,114 50	
	97,518 03	
Less estimated actual exp. of Comp's Transportation,	7,000 00	
		90,518 03
Leaving Net Profits,		$133,737 69

Or about 6 per cent. on our whole expenditure, a portion of which was not brought into use until late in December. Apart from the expenditures on the branches, which have as yet yielded nothing, the profits of the company would be nearly 8 per cent., and if we could have charged 6¼ cents per mile for Passengers, they would have been over that rate.

This result obtained during a period of unparalleled depression

and embarrassment in the business of the country, will be considered highly satisfactory, and must afford to the stockholders renewed confidence in their enterprise, which requires only to be extended to the State work, to be made one of the most important lines in the country.

Our locomotives are generally in an excellent condition, and adequate to a much larger business than we have had this year. The Georgia and Pennsylvania, the oldest engines of the company, have undergone a thorough repair, and are now, in consequence of the better adaptation of their parts to the circumstances of our road, more valuable machines than when first received.

The accompanying statement, marked No. 7, will exhibit the performance of each engine, and the cost of their repairs; the whole distance run by all the engines, is 152,520 miles, and the expenses of the motive power department, $30,011 05—equal to 19⅔ cents per mile. Or, the whole expenses of the road are equal to 63¾ cts. per mile, for each mile the engines have run. The ordinary repairs of the engines, including the re-building of the Pennsylvania and Georgia, are $8,758 28.

The completion of the Athens branch in December last, opened the question relative to the most advantageous power to be used upon it; a question which I have not yet fully determined. The existing arrangement, which is a mixed steam and horse power, answers very well under present circumstances, but when the road begins to decay, steam power will have to be abandoned entirely, or an engine procured that will be suited to the road and trade to be transported. Light engines have hitherto been so inefficient, that until the late improvement of Mr. Baldwin, by which the adhesion of the whole machine is obtained, and at the same time the truck left free to adapt itself to the curve and undulations of the road, I had despaired of their success under any circumstances.

This improvement, however, if there shall not be found some practicable objection to it, after a sufficient trial has been made, must add greatly to the value of freight roads. The adaptation of the weight of the engine to the character and circumstances of the road, which has heretofore been a desideratum, may then be considered as attained.

Mr. B. has offered to furnish an engine of the kind referred too, upon reasonable terms, which will not weigh more on the driving wheels, than is borne by either pair of wheels of our freight cars. As the purchase of such a machine would involve an expense, which under the present exigencies of the company cannot be well incurred, I have left open for future decision, permanent arrangements for conducting the business of the branch—in the mean time, the resources of the country drained by this arm of our enterprise, will be developed, and the extent of the trade to be accommodated by it better known.

As the small cost of grease used for our cars, averaging but little over $2,25 per 1,000 miles run by the trains since we commenced business, has created doubts in the minds of some, as to its correct-

ness; I will observe that the saving in comparison with other roads has been effected by the adoption and adherence to the use of tallow, instead of oil, using but a small quantity of the latter in cold weather. During the past winter, we have been induced by the low price of lard, to make trial of its properties, which has given great satisfaction. Tallow, however, is to be preferred in warm weather.

The cost of maintaining the Way, has, this year, been considerably swelled, which is partly to be attributed to our larger business and the increased length of the road, but chiefly to the wearing out and decay of the timber, on the first fifty miles from Augusta. The average cost of keeping up the line in use, is $276 00 per mile, or for the whole road, $264 33 per mile.

For the next year, there will be a further increase in this item of our expenses, when, it will have attained its maximum, and will probably decrease.

The duration of timber in the exposed situations in which it is placed in railroads, we find will not exceed in this latitude, an average of 5 years. This rapid destruction of the chief material, that enters into the construction of railroads, calls loudly for some remedy. A number of persons stimulated by the expected profits of the discovery, have been constantly engaged in search of an antidote; among whom Mr. Kyan and Mr. Earl have attracted the most attention in this country.

The materials used by both of these gentlemen, had been previously known and applied to wood, as powerful antiseptics, and I believe their only claim to originality, is in the mode of their application, and proportions used. The process of Mr. Kyan, has been sufficiently tested, to satisfy those who have used it, that it at least doubles the duration of wood, and consequently, where this material is costly, it must be very valuable. Its cost at the existing price of corrosive sublimate, is about $10 per thousand feet, board measure, equal to the first cost of our lumber, consequently requiring an outlay which the present experience of its advantages, would not in our case justify. In Mr. Earl's process, Salts, (sulphates of Iron and Copper,) are used, that are cheap and abundant. This preparation is highly recommended by eminent chemists, and has the additional advantage of costing about one half of Kyanizing—but there is as yet insufficient experience as to its advantages.—There are a variety of other substances that have been applied to the preservation of timber, among which, common salt may be mentioned as the most important. It has been used successfully on the Camden and Amboy railroad, and is thought by the managers of that work, owing to its cheapness, to be preferable to any other. A small experiment has been made upon our road, by which its merits will be tested in a few years. Other roads in our State, are trying Mr. Earl's patent on a large scale, the result of which it will, perhaps, be our best policy to wait.

The present knowledge of this science, is too limited for us to derive any decided advantage from it, but I have strong hopes, that

the daily increasing importance of the subject, will yet develope—if it has not already been discovered—some cheap method by which this great desideratum can be obtained. The advantages of such a discovery to Railroads, will be incalculable, and must add greatly to the value of their stocks.

The transportation of the United States mail, in both directions after night over our road, has, owing to the numerous freshets this year, been attended with increased hazard, and one serious accident. In consequence, several attempts have been made, without success, to get released from our contract. We have asked this concession from the Department, the more unreservedly, as one of the prominent inducements held out to us, by the then Post Master General, to enter into the contract, has failed. We were assured by him, that no detention should take place to the travel between New York and New Orleans; instead of which, there have been delays continually occurring, either at Charleston, Washington, Baltimore, or Philadelphia, and sometimes at all of these places in one or the other direction.

In consequence of the greater cheapness of the route from New Orleans to New York, by the Ohio river, we could only hope to compete for the travel—when that river is navigable—by giving it the greatest possible despatch; hence the importance attached to this promise.

It has been urged by the department, that every effort has been made that could be done *legally*, to overcome these detentions.—Such may be the case under the circumstances, but it is well known, that a more liberal and sound construction of the Act of Congress, which leaves the amount of compensation almost wholly with the Post Master General—would have enabled him to have surmounted all these difficulties. The law of Congress on the subject, allows the Department to give 25 per cent. more than similar service can be had for in stage coaches; and as if with a view to determine what that amount should be, in our case, proposals were invited for the transportation of the mails, in coaches, parallel with our road, at 7 miles per hour, and the lowest offer received, was $350 per mile; to which, if he had added 25 per cent. as provided for by Congress, would have given us $437,50; yet in the very face of this result, he decided, irrevocably, that the act referred to, fixed the maximum rate of compensation on main lines of railroads, at $237,50, without regard to circumstances. We finally accepted his terms, and found them much more onerous than expected. The degrading spectacle is now exhibited, of a *great* government receiving at the hands of a *poor* corporation, a compulsory service at less than its actual cost Ours is not an isolated case—nearly every railroad company on the Great Mail Route, has the same complaints to make of the unreasonable demands of the Government.

To show that railroad companies have not been exhorbitant in their proposals to the department, it may be stated, that in England, on the great thoroughfares, where the travel alone is sufficient to fill three or more daily trains in each direction, Government pays

$600 per mile, and at this rate, it is deemed cheaper to the Post Office Department, than the old coach service, as the increased speed of the mails, increases also the correspondence of the country, adding in a greater ratio to the revenues of the department, than to its expenses. Before another meeting of our Stockholders, we shall be called upon again, to bid for the transportation of the Great Mail, when we can obtain more favorable terms, or refuse the service altogether.

In reviewing our past year's business, I cannot but again repeat, that I am satisfied with the result. It is true that it falls short of our calculations made in 1836 and 1837—years of universal inflation in the business of the country. But it is still far short of what it will be when our road is united with the great west.

Upon a business this year of about 11,000 tons, and an average of 62 passengers per day, we have received above our expenses, $133,737 on a productive capital of about $1,800,000. A capital invested too, during the reign of these inflations, and which, if the work was now to be executed, could be done for nearly half a million less.

If results such as these, can be obtained during a period of universal despondency—"when the most prosperous among us doubt the foundation of their prosperity,"—what may we not reasonably expect when confidence shall again be restored, and we shall have become participators in the trade of the west. A trade which yields to the Erie canal a tonage 120 times greater than ours, and to various other improvements south of it, nearly an equal amount, not to include that which is floated around the capes of Florida. In considering this subject, it is not to be lost sight of, that Georgia possesses the only route to the west, south of the Erie canal, by which it can be reached, on gradients so low as 37 feet per mile.

The daily improvements in the machinery and construction of railroads, show their capabilities and value have not yet been fully developed. It has been but 12 years since their introduction as avenues of general commerce, and in that short space, they have grown so rapidly in public estimation, that now the most sceptical on the subject are constrained to admit, that they are almost in all cases, greatly superior in point of economy for the transportation of passengers and freight, to their former rivals, canals, or any other artificial way where the amount of trade to be accommodated, is sufficient to authorize their construction in a substantial manner.

That there have been many visionary railroad projects in this country commenced and executed, where the old Indian trail would have been a more appropriate avenue of commerce, is a fact too sensibly felt by a host of sanguine and deluded participators, to admit of question; nor has our own State been free from these excesses. Under the influence and abuse of the credit system, roads have been constructed in Georgia years in advance of the requirements of the population of the country through which they pass.

These instances of failures which all ought to have seen, cannot be adduced as arguments against the system. We are now,

however, arriving at an era in regard to them, when the apparent mystification which has heretofore hung over their operations is clearing off, and their merits will then be properly appreciated.

Respectfully submitted by

Your Obedient Servant,

J. Edgar Thomson,

Chief Engineer and General Agent.

STATEMENT OF THE EXPENSES INCURRED FOR WORKING THE GEORGIA RAILROAD, FROM APRIL 1st 1841, TO APRIL 1st 1842.

Conducting Transportation.		
Stationary, Printing, etc.	$777 56	
Loss and Damage,	1,909 18	
Incidentals,	1,624 68	
Oil and Tallow for Cars,	402 72	
Provisions, Clothing, Doctors Bills and other expenses of Negroes,	2,849 42	
Expenses of Mules and pay of Conductor, Warrenton Branch,	1,062 62	
Expenses of Horse Car on Athens Branch, for first Quarter,	583 34	
Wages of Laborers,	2,022 24	
Agents and Clerks,	8,742 88	
Conductors,	2,024 83	
Work done by Car Factory, repairing Depot Buildings,	220 50	
Do. making new Turning Platform, etc.,	480 00	
		22,699 97
Motive Power.		
Stationary, Printing, etc.,	13 08	
Expenses of Water Stations,	2,518 11	
Incidentals,	329 49	
Fuel,	7,186 61	
Oil and Packing, etc., for Engines,	1,538 73	
Ordinary Repairs of Engines,	8,758 28	
Extraordinary Repairs of Engines,	852 00	
Engine and Firemen,	7,079 33	
Provisions, Clothing, Doctor's Bills and other Expenses of Negroes,	1,735 42	
		30,011 05
Maintenance of Way.		
Stationary and Printing,	13 00	
Men's Wages,	19,549 58	
Provisions, Clothing, Doctors Bills and other Expenses of Negroes,	2,703 06	
Incidentals,	511 99	
Tools,	826 99	
Iron and Spikes,	550 47	
Wooden Rails, Cross Ties, etc.	11,382 80	
Supervisors,	1,733,29	

Work done by Car Factory,	511, 16	
Work done by Machine Shops,	910 17	
		38,692 54
Maintenance of Cars.		
Ordinary Repairs,	3,660 00	
Extraordinary Repairs,	1,287 00	
Renewal of Wheels,	1,167 50	
		6,114 50
		$97,518 03

Statement of Dividends declaired on the Stock of the Georgia Railroad and Banking Company.

Date of making up accounts for dividend.			No. of div.	Stock p'd in on which div. was p'd.	Amount of dividend. *Dol.*	*Cents.*	REMARKS.
Nov.	7,	1836.	1	858,615	26,018		
Feb.	20,	1837.	2	1,170,715	41,452	80	
Oct.	2,	1837.	3	1,434,405	53,962	54	
April	2,	1838.	4	1,919,215	70,492	90	
Oct.	1,	1838.	5	2,011,895	80,300	96	
April	1,	1839.	6	2,116,810	84,178		Declared June, 1839.
Oct.	7,	1839.	7	2,143,317	86,234	68	" Jan., 1840.
April	6,	1840.	8	2,193,952	86,513	48	
April	4,	1842.	9	2,201,612	220,161	20	Res'd fund $86,546 51

OFFICE GEORGIA RAILROAD & BANKING COMPANY,
Athens, May 9, 1842.

The preceding statement, is taken from the Books of this Office.
JAMES CAMAK, *Cashier.*

THE MONSTER STEAM SHIP.—This vessel, which is nearly ready to be launched, is built by three or four spirited individuals on their own speculation in the small town of Derry, Ireland, where a few months previously it was never supposed that a vessel of her magnitude would ever be built; her dimensions are 222 ft. in length between perpendiculars, 37 feet beam, and 26 feet deep in the hold, burthen 1750 tons, B. M., she is to be fully rigged as a 50 gun frigate, the length of main mast to be 90 feet and 33 inches diameter, main yard 79 feet and 22½ feet diameter in the slings, foremast 83 feet and mizen mast 76 feet, she will be able to spread 6,400 yards of canvas. There are three decks, the upper one to be left entirely clear for action, and to be pierced for 44 guns, the windlass and catspan gear will be placed 'twixt decks. She is to be propelled by Smith's Archimedean Screw, which will be 12 ft. diam. and 14 ft. pitch, but the length will be only 7 ft.; it is to make 88 revolutions per minute, the gearing consists of a cog wheel 20 ft. diam., working into a smaller wheel of 5 ft. diam., upon whose axis is the shaft of the screws.—*Engineer and Architects Journal.*

(inches)